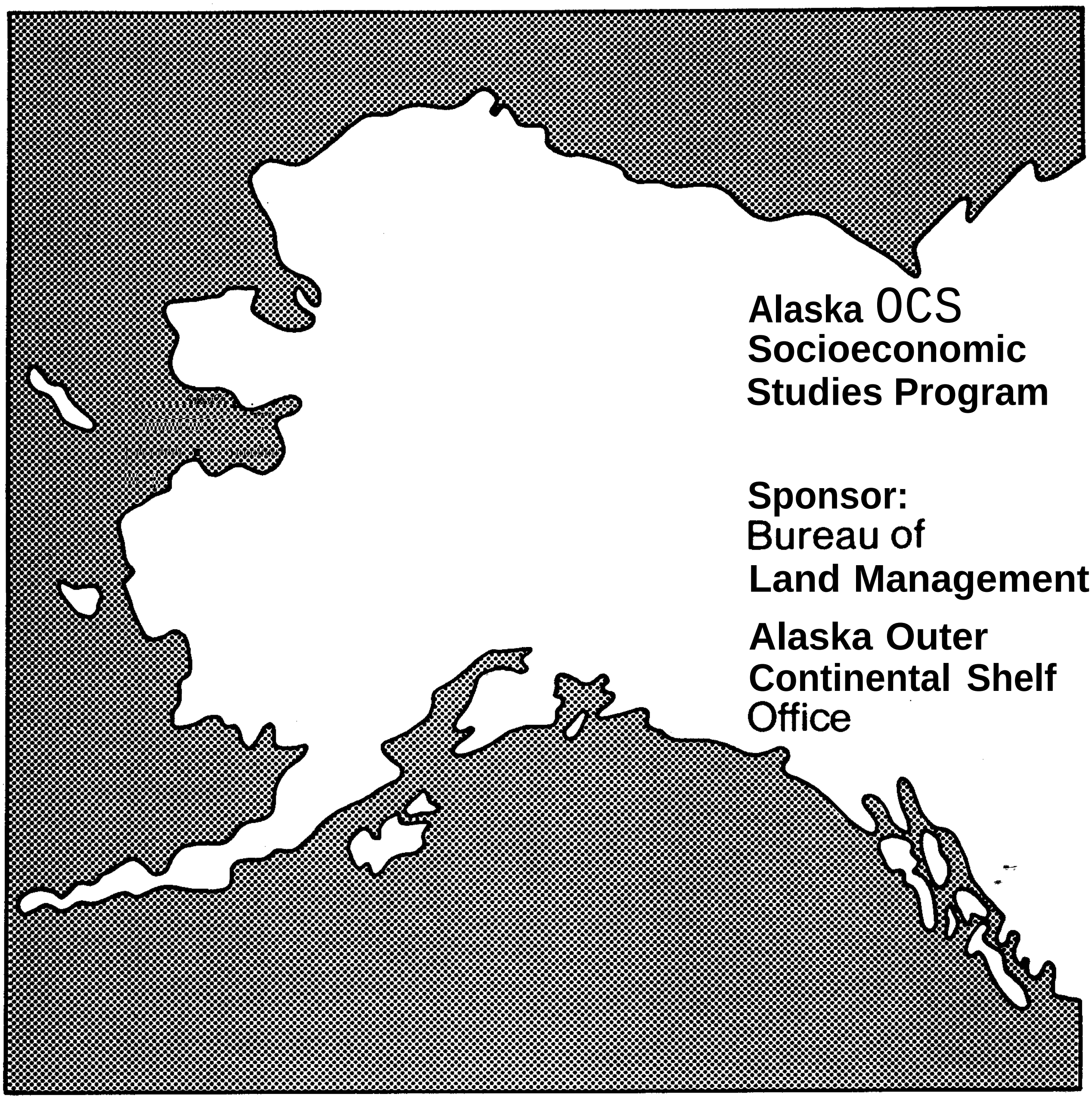
Technical Report Number 29a



Alaska OCS Socioeconomic Studies Program

Sponsor:
Bureau of Land Management
Alaska Outer Continental Shelf Office

Northern Gulf of Alaska Petroleum Development Scenarios Executive Summary

The United States Department of the Interior was designated by the Outer Continental Shelf (OCS) Lands Act of 1953 to carry out the majority of the Act's provisions for administering the mineral leasing and development of offshore areas of the United States under federal jurisdiction. Within the Department, the Bureau of Land Management (BLM) has the responsibility to meet requirements of the National Environmental Policy Act of 1969 (lJ_EPA) as well as other legislation and regulations dealing with the effects of offshore development. In Alaska, unique cultural differences and climatic conditions create a need for developing additional socioeconomic and environmental information to improve OCS decision making at all governmental levels. In fulfillment of its federal responsibilities and with an awareness of these additional information needs, the BLM has initiated several investigative programs, one of which is the Alaska OCS Socioeconomic Studies Program.

The Alaska OCS Socioeconomic Studies Program is a multi-year research effort which attempts to predict and evaluate the effects of Alaska OCS Petroleum Development upon the physical, social, and economic environments within the state. The analysis addresses the differing effects among various geographic units: the State of Alaska as a whole, the several regions within which oil and gas development is likely to take place, and within these regions, the various communities.

The overall research method is multidisciplinary in nature and is based on the preparation of three research components. In the first research component, the internal nature, structure, and essential processes of these various geographic units and interactions among them are documented. In the second research component, alternative sets of assumptions regarding the location, nature, and timing of future OCS petroleum development events and related activities are prepared. In the third research component, future oil and gas development events are translated into quantities and forces acting on the various geographic units. The predicted consequences of these events are evaluated in relation to present goals, values, and expectations.

In general, program products are sequentially arranged in accordance with BLM's proposed OCS lease sale schedule, so that information is timely to decision making. In addition to making reports available through the National Technical Information Service, the BLM is providing an information service through the Alaska OCS Office. Inquiries for information should be directed to: Program Coordinator (COAR), Socioeconomic Studies Program, Alaska OCS Office, P. O. Box 1159, Anchorage, Alaska 99510.

TECHNICAL REPORT NO. 29a

ALASKA OCS SOCIOECONOMIC STUDIES PROGRAM
NORTHERN GULF OF ALASKA
PETROLEUM DEVELOPMENT SCENARIOS

EXECUTIVE SUMMARY

Prepared for

BUREAU OF LAND MANAGEMENT
ALASKA OUTER CONTINENTAL SHELF OFFICE

Prepared by

DAMES & MOORE

March 1979

Contract No. AA550-CT6-61,
Task 9BA

Job No. 8699-016-20

NOTICES

1. This document is disseminated under the sponsorship of the U.S. Department of the Interior, Bureau of Land Management, in the interest of information exchange. The U.S. Government assumes no liability for its content or use thereof.

2. This final report is designed to provide preliminary petroleum development data to the groups working on the Alaska OCS Socio-economic Studies Program. The assumptions used to generate off-shore petroleum development scenarios may be subject to revision.

3. The units presented in this report are metric with American equivalents except units used in standard petroleum practice. These include barrels (42 gallons, oil), cubic feet (gas), pipeline diameters (inches), well casing diameters (inches), and well spacing (acres).

ALASKA OCS SOCIOECONOMIC STUDIES PROGRAM
Northern Gulf of Alaska
Petroleum Development Scenarios
Executive Summary

Prepared by

DAMES & MOORE

March 1979

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1.0 INTRODUCTION

Purpose

In order to analyze the socioeconomic and environmental impacts of northern Gulf of Alaska petroleum exploration, development, and production, it is necessary to make reasonable and representative predictions of the nature of that development. The petroleum development scenarios in this report serve that purpose; they provide a "project description" for subsequent impact analysis. The socioeconomic impact analysis of the Northern Gulf of Alaska petroleum development postulated in this report will be contained in a subsequent report of-this study program.

Particularly important to socioeconomic studies are the manpower, equipment, and material requirements, and the scheduling of petroleum development. The scenarios have to provide a reasonable range of technological, economic and geographic options so that both minimum and maximum development impacts can be discerned. The primary purpose of this report is, therefore, to describe in detail a set of petroleum development scenarios that are economically and technically feasible, based upon available estimates of oil and gas resources of the northern Gulf of Alaska.

This study, along with other studies conducted by or for the Bureau of Land Management, including the environmental impact statements produced preparatory to OCS lease sales, are mandated to utilize U.S. Geological Survey estimates of recoverable oil and gas resources in any analysis requiring such resource data.

Scope

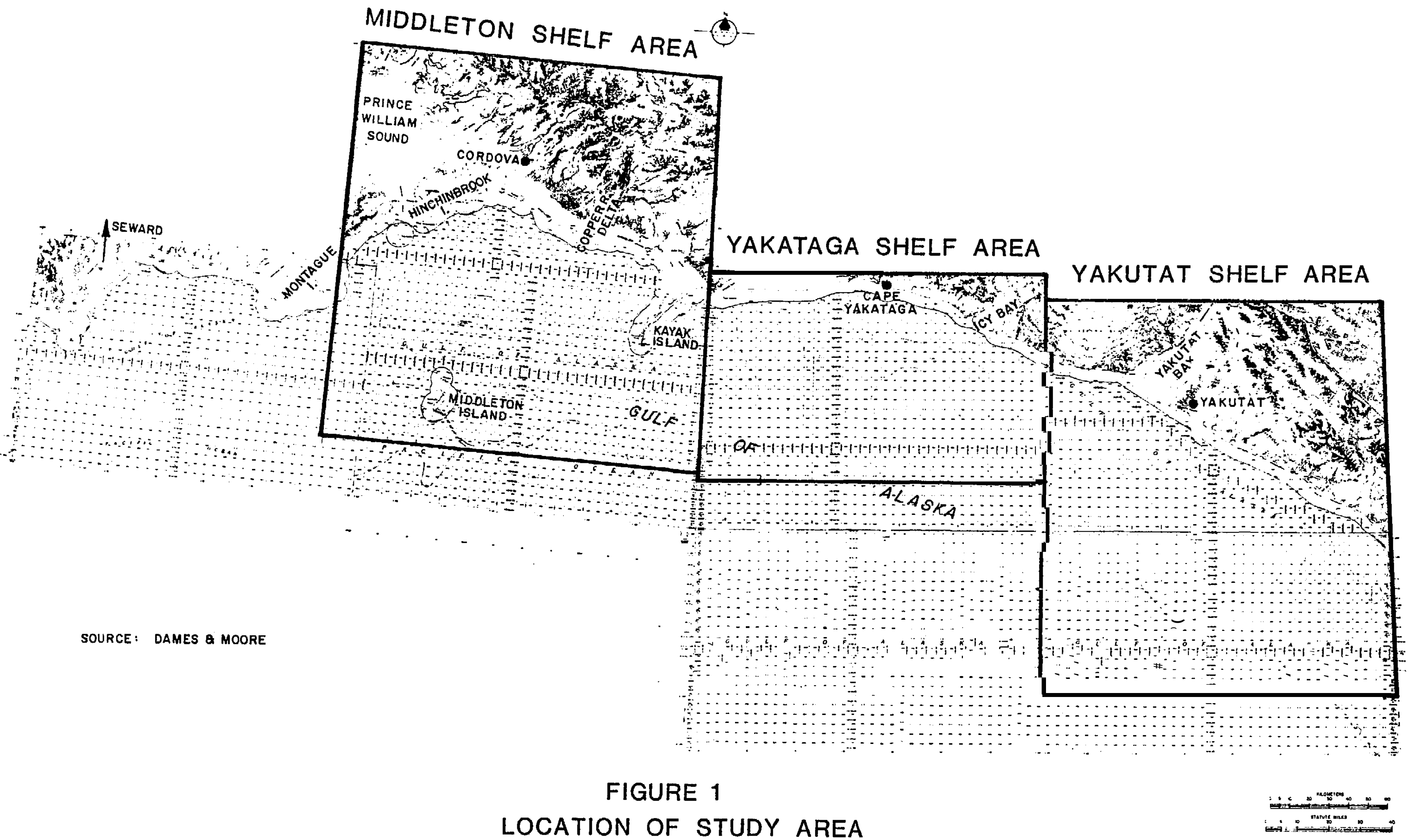
The petroleum development scenarios formulated in this report are for the proposed Gulf of Alaska OCS lease sale No. 55, currently scheduled for June of 1980. This is a second generation lease sale following an earlier Gulf of Alaska OCS lease sale (No. 39) held April 13, 1976. Eleven unsuccessful exploratory wells have been drilled on the 1976 leases and no plans have been announced for further drilling at this time. In this study, it has been assumed that earlier exploratory interest will renew on the existing leases prior to their, expiration or new leases will be sold. Allocation of the U.S. Geological Survey resource estimates has been based on the assumption of significantly reduced potential for the existing lease sale area and the remainder of the Yakataga Shelf.

The study area considered in this investigation is that defined in the call for nominations which appeared in the Federal Register, in May 25, 1978. This area extends approximately 724 kilometers (450 miles) from Cape Fairweather in the east to Cape Clear (on Montague Island) in the west, from the three-mile limit to beyond the 200 meter (650-feet) isobath encompassing area of about 4.2 million hectares or 10.4 million acres (see Figure 1). The area thus defined for the most part lies within the area that can be developed for oil and gas with current or imminent technologies.

The U.S. Geological Survey estimates that from the basis of this study are as follows (Plafker et al., 1978):

	95 Percent Probability	50 Percent Probability	5 Percent Probability	Statistical Mean
Oil (billions of barrels)	0	0.5	4.4	1.4
Gas (trillions of barrels)	0	2.0	13.0	5.0

This study details scenarios for the five percent statistical mean and 95 percent probability levels of the U.S.G.S. resource estimates. In addition, a scenario specifying exploration only is detailed. Since the 95 percent probability level identifies no commercial resources, the exploration only and 95 percent cases are essentially one and the same. Therefore, this study formulates three scenarios corresponding to the five percent and statistical mean resource levels and/or no commercial discoveries resulting in exploration only.



SOURCE: DAMES & MOORE

FIGURE 1
LOCATION OF STUDY AREA

Methodology

The construction of petroleum development scenarios commences with allocation of the U.S.G.S. resource estimates between several sub-basins of the Gulf of Alaska Tertiary Province and the formulation of a set of reservoir, hydrocarbon and production assumptions which include basic analytical assumptions necessary to conduct the economic analysis.

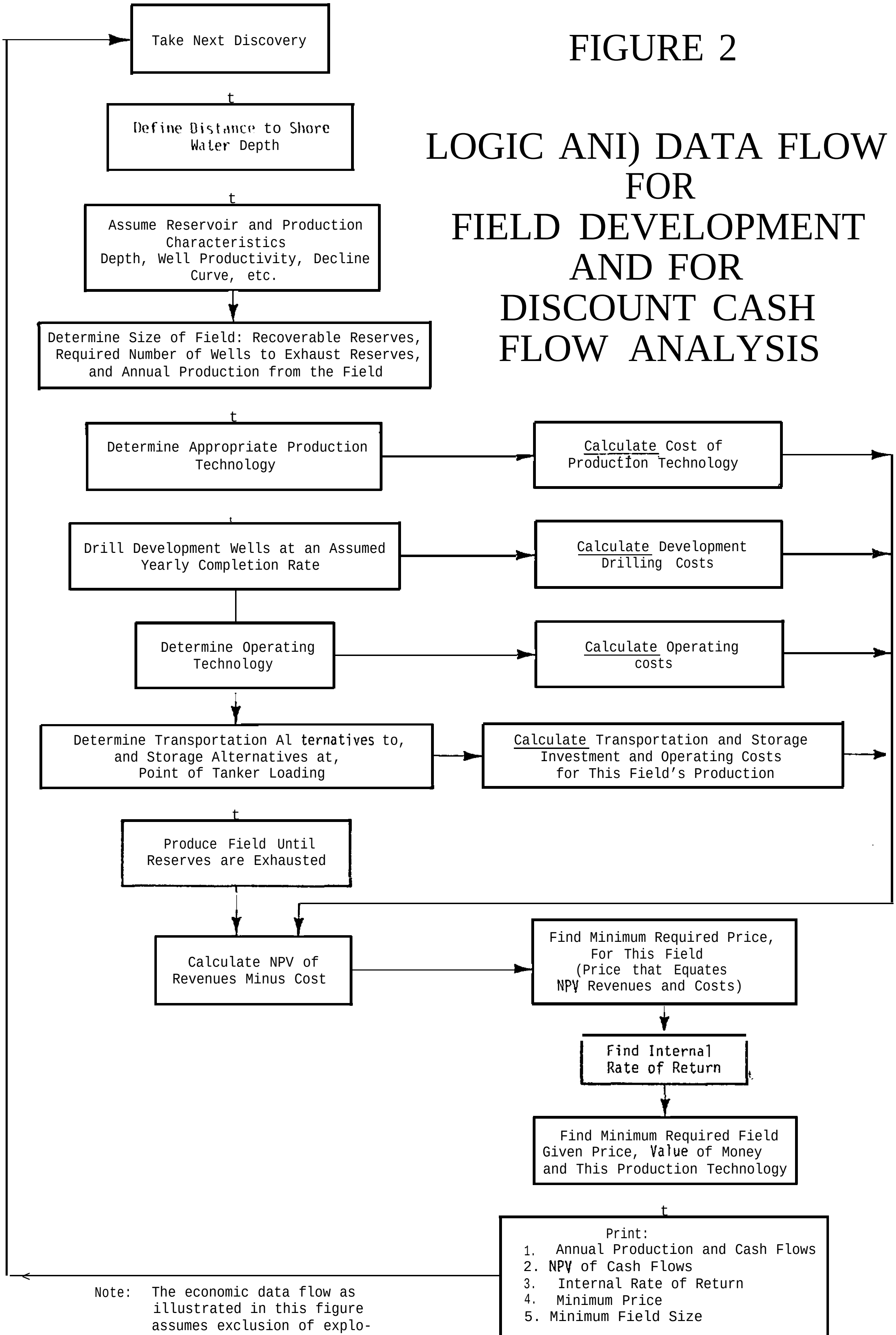
A review of existing and imminent petroleum exploration, development and transportation technologies in similar operating environments is made in order to construct a technology model which identifies a number of production system options to be screened in the economic analysis. An integral part of this review is the identification of petroleum development and operating costs which are the basic input in the economic analysis. The scheduling of field development construction activities is also a product of the technology review and provides the basic input for the analysis of manpower requirements both in terms of the individual petroleum facility/activity components and the total scenario manpower estimates.

The siting criteria and potential sites for onshore petroleum facilities such as oil terminals, LNG plants and staging areas along the northern Gulf of Alaska shoreline are examined to provide locational criteria for scenario facility siting and to determine ranges of pipeline distances to be screened in the economic analysis.

One objective of the economic analysis is to evaluate the relationships among several likely oil and gas production technologies suitable for conditions in the Gulf of Alaska and the minimum field sizes required to justify each technology at various water depths. The logic and data flow of this analysis are illustrated in Figure 2. The model calculates the net present value of developing certain field sizes with a given technology appropriate for a selected water depth and distance from potential shore terminal site. The water depth and distance to shore values selected for input into the model are representative ranges anticipated in the lease areas. Field sizes selected for economic

FIGURE 2

LOGIC ANI) DATA FLOW FOR FIELD DEVELOPMENT AND FOR DISCOUNT CASH FLOW ANALYSIS



Note: The economic data flow as illustrated in this figure assumes exclusion of exploration costs in the analysis.

screening are consistent with the resource estimates and allocations; test cases using raw cost data were run prior to the full analysis to establish the range of parameters for input to the economic analysis (e.g. the smallest field size to be considered).

Although the economic analysis defines those cases which are uneconomic (under the assumptions of the analysis), there still remain an infinite number of permutations of field size, production technologies and discovery locations which are demonstrated to be economic. From these permutations a set of skeletal scenarios are defined based primarily on variation in potential for onshore development, which is a function of such factors as field size, field distribution, location, and production technology. Essentially, the skeletal scenarios defined varying amounts of oil that would be brought to shore vs. offloaded directly to tankers offshore.

Bureau of Land Management, Alaska OCS Office staff then selected a developmental option (skeletal scenario) for each resource level (five percent, statistical mean and no commercial resources or exploration only).

The detailed (selected) scenarios are described according to environmental setting, development scheduling, facility equipment and manpower requirements. Although these scenarios are in essence hypothetical developments, they have been formulated to provide reasonable and representative predictions given the available data base on the course of possible petroleum development in the Gulf of Alaska and given the potential resource base identified by the U.S. Geological Survey.

This study was conducted concurrently with a similar study of the western Gulf of Alaska OCS lease sale (No. 46). The data collection, analytical procedures and economic screening parameter selection were structured to be applicable, when appropriate, to both studies. The economic analysis, for example, encompasses anticipated conditions in both areas; when contrasts exist that affect the analysis, they are noted in the text.

2.0 SUMMARY OF FINDINGS

Selected Petroleum Development Scenarios

The three petroleum development scenarios described in this report correspond to the 95 percent probability level, statistical mean and five percent probability level resource estimates of the U.S. Geological Survey. Since the 95 percent probability level estimate indicates no resources, the scenario related to this estimate details an unsuccessful exploration program (no commercial resources discovered). The statistical mean and five percent probability resource level scenario predict commercial discoveries which can be considered as medium and high find cases respectively.

Two options were considered for the exploration only scenario - (i) a high level of exploratory activity assuming high industry interest, and (ii) a low level of exploration activity indicating a low level of industry interest; the high interest or optimistic case was selected for detailing.

The options considered for the five percent resource level scenario presented contrasting potentials for onshore development, in particular, the amount of oil brought to shore. The maximum onshore impact option was based on the assumption that most oil would be brought to shore via pipeline, processed at one or more marine terminals and transshipped to the lower 48 states. The minimum onshore impact case assumed that approximately 40 percent of oil production would be loaded offshore directly to tankers; in this case a number of fields were assumed to be widely dispersed or isolated, and unable to economically justify a pipeline to shore and shore terminal. An intermediate case was also defined with the amount of oil produced to shore somewhat less than the maximum shore impact case. The minimum onshore impact case was selected for detailing.

At the statistical mean resource level similar options were identified; the minimum onshore impact case was also selected.

For non-associated gas fields comprising both the five percent and statistical mean resource levels, all production was assumed to be pipelined to shore and converted to LNG for export to the lower 48. No options, therefore, were identified for the production of natural gas resource at each resource level.

EXPLORATION SCENARIO

As indicated on Table 1, the exploration only scenario assumes a high level of exploration activity with a total of 28 wells drilled. Exploration ceases after the fourth year with only small non-commercial hydrocarbon deposits found. Exploratory activity is centered on the Yakutat Shelf with a lesser number of wells drilled on the Middleton and Yakataga Shelves.

FIVE PERCENT PROBABILITY RESOURCE LEVEL SCENARIO

Tables 2 and 3 and Figures 3, 4 and 5 summarize the major characteristics of this scenario. The total reserves discovered and developed are:

	Oil (MMbbl)	Gas-Associated (Bcf)	Gas-Non-Associated (Bcf)
Middleton Shelf	700	650	2,600
Yakataga Shelf	400	--	--
Yakutat Shelf	3,300	1,950	7,800
Totals	4,400	2,600	10,400

Eight oil fields and four non-associated gas fields are discovered and developed on the Yakutat Shelf; a single oil field is discovered and developed on the Yakataga Shelf; three oil fields and two non-associated gas fields comprise the reserves developed on the Middleton Shelf.

A major oil terminal and LNG plant located on the east shore of Yakutat Bay take most of the production from the Yakutat Shelf fields. Oil and

TABLE 1

EXPLORATION ONLY SCENARIO

Shelf	Year After Lease Sale							
	1		2		3		4	
	No. of Rigs	No. of Wells	No. of Rigs	No. of Wells	No. of Rigs	No. of Wells	No. “of Rigs	No. of Wells
YAKUTAT	3	7.2	2	4.8	1	2.4	1	0.6
YAKATAGA			1	2.4	1	2.4	1	0.2
MIDDLETON	1	2.4	1	2.4	1	2.4	1	0.8
TOTALS	4	9.6	4	9.6	3	7.2	3	1.6

TOTAL WELLS = 28

5% PROBABILITY RESOURCE LEVEL SCENARIO:
OIL AND ASSOCIATED GAS PRODUCTION

Shelf	Field Size: Oil (MMBBL)	Field Size: Gas (BCF)	Production System	Platforms No./Type[1]	Number of Production Wells	Peak Production: Oil (MB/D)	Peak Production: Gas (MMCF/D)	Water Depth Meters (feet)	Distance to Shore Terminal[2] Kilometers (miles)	Pipeline Diameter (inches): Oil	Pipeline Diameter (inches): Gas
Yakutat Group 1	1000	1000	Steel and concrete platforms, shared trunkline to shore terminal.	2 S 1 C	120	288	288	122-152 (400-500)	56-81 (35-50)	32-34 Trunkline from Group 1 fields to shore terminal with 672 MB/D peak through-put.	36-38[3]
	500	950	Steel platforms, shared trunkline to shore terminal.	2 S	80	192	364.8	122-152 (400-500)	56-81 (35-50)		
	350	--	Steel platforms, shared trunkline to shore terminal.	1 S	40	96	--	122-152 (400-500)	56-81 (35-50		
	250	--	Steel platforms, shared trunkline to shore terminal.	1 S	40	96	--	122-152 (400-500)	56-81 (35-50	--	--
	400	--	Single concrete platform with storage, offshore loading.	1 C	40	96		152-183 (500-600)	--	--	--
	250	--	Single steel platform with storage buoy, offshore loading.	1 S	40	96		152-183 (500-600)	--	--	--
	300	--	Single concrete platform with storage buoy, offshore loading.	1 C	40	96		122-152 (400-500)	--	--	--
	250	--	Single steel platform, no storage, offshore loading.	1 S	40	65		61-91 (200-300)	--	--	--
Yakataga	400		Single concrete platform with storage, offshore loading.	1 C	40	96		152-183 (500-600)	--	--	--
Middle ton	350	650	Single steel platform with gas & oil pipelines to shore terminals.	1 S	40	96	178	91-122 (300-400)	48-64 (30-40)	14-16	24[4]
	150		Single steel platform, no storage, offshore loading.	1 S	30	72		61-91 (200-300)	--	--	--
	200		Single steel platform, storage buoy, offshore loading.	1 S	40	96		61-91 (200-300)	--	--	--
TOTAL	4,400	2,600		15	590	[5]	[5]				

[1] S = Steel, C = Concrete
[2] Yakutat Bay and Hinchinbrook Island area.
[3] Gasline tied-in with non-associated gas: 2.0 BCF/D peak throughput.
[4] Gasline tied-in with non-associated gas: 826 MMCF/D peak throughput.
[5] These fields will not peak at the same time. The time and level of overall peak is not yet determined.

TABLE 3

5% PROBABILITY RESOURCE LEVEL SCENARIO
NON-ASSOCIATED GAS PRODUCTION

Shelf	Field Size (BCF)	Production System	Platforms No. /Type[1]	Number of Production Wells	Peak Production (MMCF/D)	Water Depth Meters (feet)	Distance to Shore Terminal[2] Kilometers (miles)	Pipeline Diameter (inches)
Yakutat	3000	1-24 well steel platforms & shared pipeline to shore	1 s	24	576	122-152 (400-500)	56-80 (35-50)	36-38 Gasline tied-in with associated gas production
	2000	1-16 well steel platform & shared pipeline	1 s	16	384	122-152 . (400-500)	56-80 (35-50)	
	1800	1-16 well steel platform & shared pipeline	1 s	16	384	122-152 (400-500)	56-80 (35-50)	
	1000	1-8 well steel platform & shared pipeline	1 s	18	192	122-152 (400-500)	56-80 .(35-50)	
Yakataga	--	--	--	--	--	--	--	--
Middleton	1600	1-16 well steel platform & shared pipeline	1 s	1 6	384	61-91 (200-300)	56-80 (35-50)	24″ gasline tied-in with associated gas production
	1000	1-8 well steel′ platform	1 s	8	192	61-91 (200-300)	56-80 (35-50)	
TOTAL	-10,400		6	88	4			

[1] S = Steel, C = Concrete

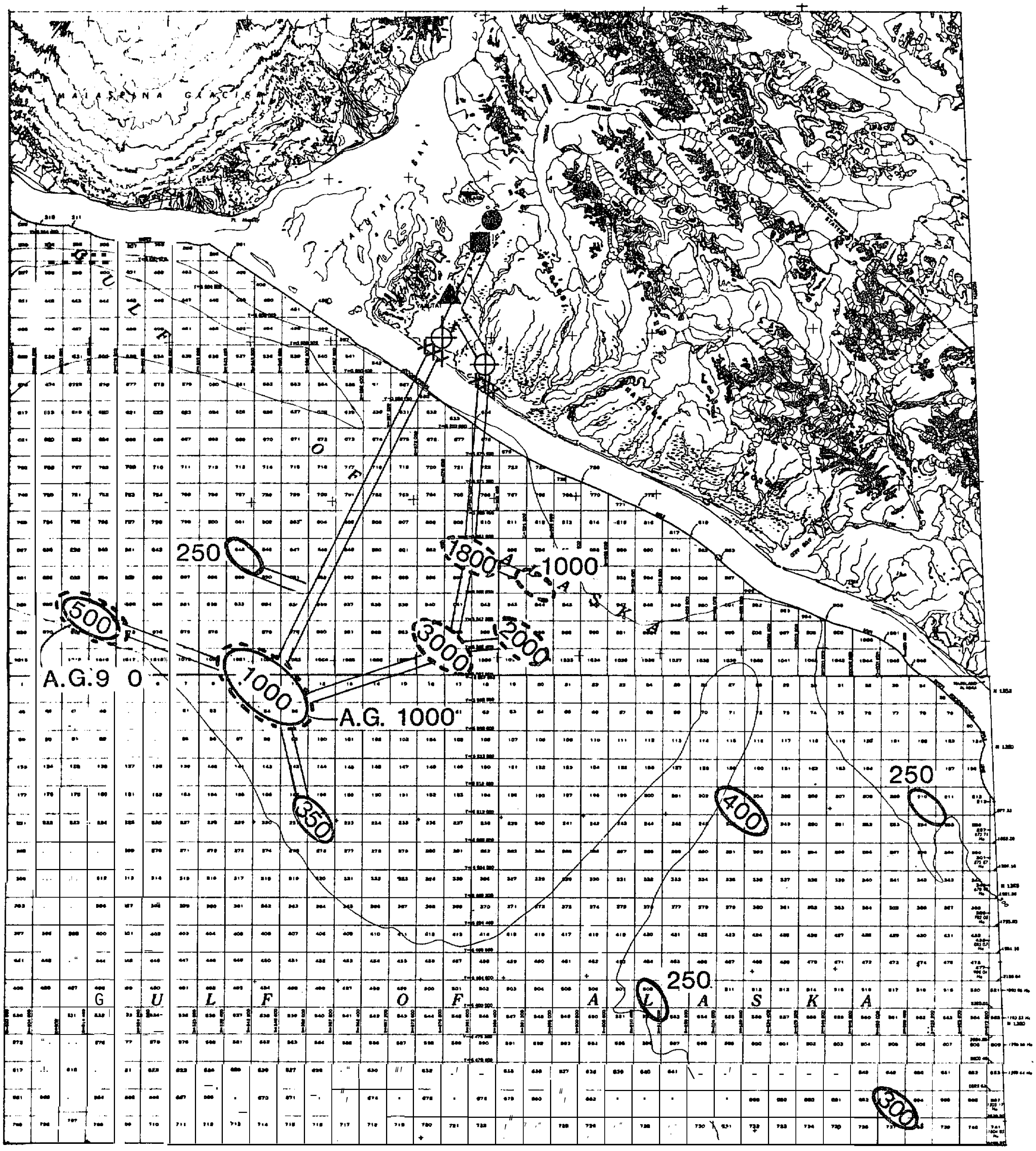
[2] Yakutat 8ay; Icy 8ay

NOTES:

1. Yakutat LNG plant peak input = 1.344 BCF/D non-associated gas plus .653 associated gas = 1.997 BCF/D; trunkline to handle 2.0 BCF/D = 36″-38″
2. Middleton LNG plant peak input =826 MMCF/D total associated and non-associated; trunkline to handle 826 MMCF/D = 24″
3. Economically recoverable gas in the Gulf of Alaska must be converted to LNG. Thus, onshore impacts from gas discoveries are identical for either maximum or minimum onshore impact cases under existing technology.
4. These fields will not peak at the same time. Time and level of overall peak is not yet determined,

FIGURE 3

YAKUTAT SHELF AREA



KEY: OIL FIELD

GAS FIELD A.G..ASSOCIA,ED GAS

OIL & ASSOCIATED GAS FIELD

XXX LANDFALL

OIL TERMINAL

PUMP STATION /BOOSTER ST ATION

PIPELINE &/OR ROAD CORRIDOR

NOTE: OIL FIELD SIZE GIVEN IN MILLION BARRELS (MMbbl)
GAS FIELD SIZE GIVEN IN BILLIO N CUBIC FEET (Bcf)

KILOMETERS
0 5 1 0 20 30 40 50 60

STATUTE MILES
0 5 10 20 30 40

SOURCE DAMES & MOORE

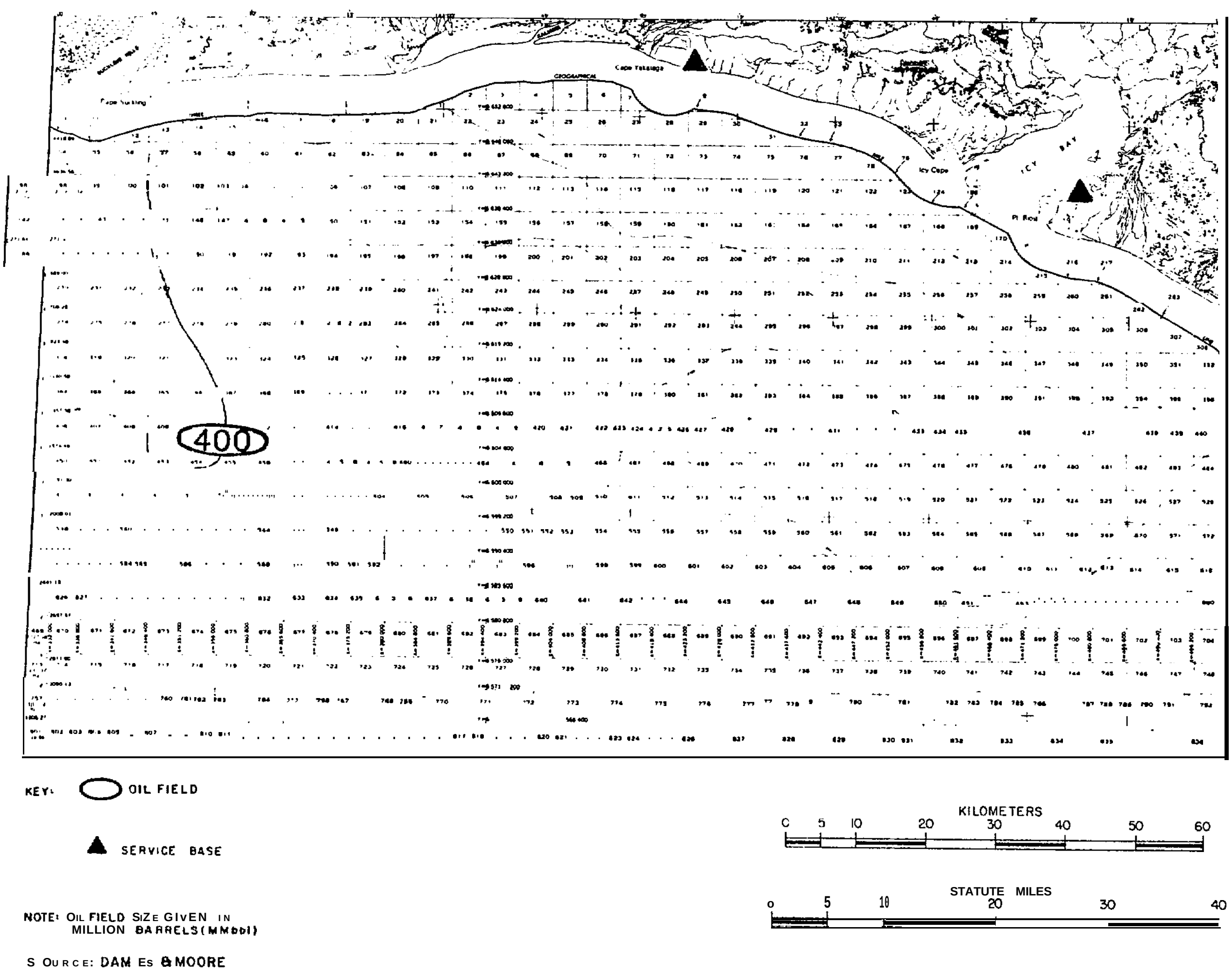
FIELD AND ONSHORE SITE LOCATIONS

5% PROBABILITY RESOURCE LEVEL SCENARIO

OIL, ASSOCIATED GAS AND NON-ASSOCIATED GAS

FIGURE 4

YAKATAGA SHELF AREA



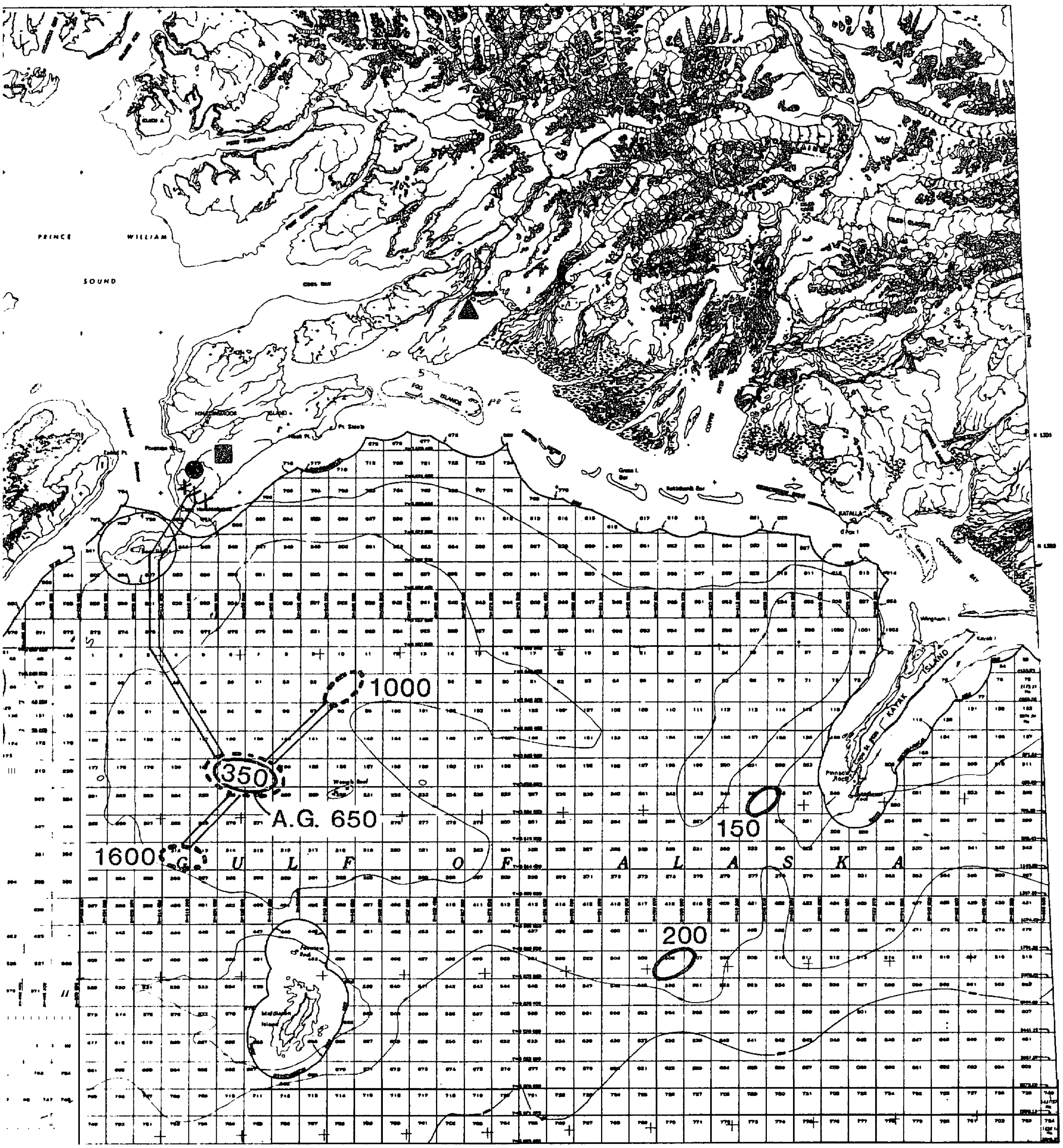
FIELD AND ONSHORE SITE LOCATIONS

5% PROBABILITY RESOURCE LEVEL SCENARIO

OIL AND ASSOCIATED GAS

FIGURE 5

MIDDLETON SHELF AREA



XXX LANDFALL

GAS FIELD A.G. = ASSOCIATED GAS

OIL & ASSOCIATED GAS FIELD

LNG PLANT

SERVICE BASE

OIL TERMINAL

PUMP STATION / BOOSTER STATION

PIPELINE &/OR ROAD CORRIDOR

NOTE: OIL FIELD SIZE GIVEN IN MILLION BARRELS (MMbbl)
GAS FIELD SIZE GIVEN IN BILLION CUBIC FEET (Bcf)

KILOMETERS 0 5 10 20 30 40 50 60

STATUTE MILES 0 5 10 20 30 40

RCE: DAMES & MOORE

FIELD AND ONSHORE SITE LOCATIONS

5% PROBABILITY RESOURCE LEVEL SCENARIO

OIL, ASSOCIATED GAS AND NON-ASSOCIATED GAS

gas production from the Middleton fields is pipelined to an oil terminal and LNG plant located at the southwestern end of Hinchinbrook Island. Four oil fields on the Yakutat Shelf, the single field on the Yakataga Shelf and two oil fields on the Middleton Shelf are offshore loaded directly to tankers.

STATISTICAL MEAN RESOURCE LEVEL SCENARIO

Tables 4 and 5 and Figures 6 and 7 summarize the major characteristics of this scenario. The total reserves discovered and developed are:

	Oil (MMbbl)	Gas-Associated (Bcf)	Gas-Non-Associated (Bcf)
Middleton Shelf	350	250	1,000
Yakataga Shelf	--	--	--
Yakutat Shelf	1,050	750	3,000
Totals	1,400	1,000	4,000

Five oil fields and two non-associated gas fields are discovered and developed on the Yakutat Shelf; one oil field and one gas field are discovered on the Middleton Shelf. No commercial discoveries are made on the Yakataga Shelf.

The Yakutat field production is processed at an oil terminal and LNG plant located on the east shore of Yakutat Bay; two isolated oil fields are offshore loaded directly to tankers. The single oil field on the Middleton Shelf produces to a pipeline which serves an oil terminal located at the southwestern end of Hinchinbrook Island. At the same location gas pipelined from the gas field and associated gas from the oil field are converted to LNG for shipment to the U.S. west coast.

Employment

OCS-related employment is determined by industry decisions about petroleum exploration and development, such as how fast to explore and how

TABLE 4

STATISTICAL MEAN RESOURCE LEVEL SCENARIO
OIL AND ASSOCIATED GAS PRODUCTION

Shelf	Field Size		Production System	Platforms	Number of Production Wells	Peak Production		Water Depth Meters (feet)	Distance to Shore Terminal[2] Kilometers (miles)	Pipeline Diameter (inches)	
	Oil (MMBBL)	Gas (BCF)		No./Type[1]		Oil O.Bf@.-	Gas @Z.lQ)-			Oil	Gas
Yakutat	300		Steel platform, storage buoy, off-shore loading	1 S	40	96		91-122 (300-400)	--		
	250		Concrete platform with storage, off-shore loading	1 C	40	96		91-122 (300-400)	--		
Group 1	200	400	Steel platform & shared pipeline to shore terminal	1 S	40	96	192	61-91 (200-300)	56-72 (35-45)	20-22[3]	18-22[4]
Group 1	150	350		1 S	30	72	168	61-91 (200-300)	56-72 (35-45)		
Group 1	150	--		1 S	30	72	--	61-91 (200-300)	56-72 (35-45)		
Yakataga	--	--	--	--	--	--	--	--	--	--	--
Middleton	350	250[5]	Steel platform & oil pipeline to shore, shore terminal	1 S	40	96	120	61-91 (200-300)	48-64 (30-40)	12-14	--
TOTAL	1,400	1,000		6	220	[6]	[6]				

[1] S = Steel, C = Concrete

[2] Yakutat Bay; Hinchinbrook Island area.

[3] Group 1 oil fields share a 20''-22" trunkline to shore terminal.

[4] Gasline tied in with non-associated gas: throughput, 864 MMCF/D.

[5] This is not economically transportable to shore. Assume it is used for platform power and reinfected.

[6] These fields will not peak at the same time. The time and level of overall peak is not yet determined.

TABLE 5

STATISTICAL MEAN RESOURCE LEVEL SCENARIO
NON-ASSOCIATED GAS PRODUCTION

Shelf	Field Size (BCF)	Production System	Platforms No. /Type[1]	Number of Production Wells	Peak Production (MMCF/D)	Water Depth Meters (feet)	Distance to Shore Terminal[2] Kilometers (miles)	Pipeline Diameter inches)
Yakutat	2000	1-16 well steel platform and shared pipeline	1 s	16	384	122-152 (400-500)	56-80 (35-50)	19-22[3]
	1000	1-8 well steel platform and shared pipeline	1 s	8	192	91-122 (300-400)	40-56 (25-35)	
Yakataga	--	--	--	--	--	--	--	--
Middleton	1000	1-8 well steel platform and pipeline	1 s	8	192	91-122 (300-400)	48-64 (30-40)	12-14[4]
TOTAL	4000		3	32	[5]			

[1] S = Steel

[2] Yakutat Bay; Hinchinbrook Island area.

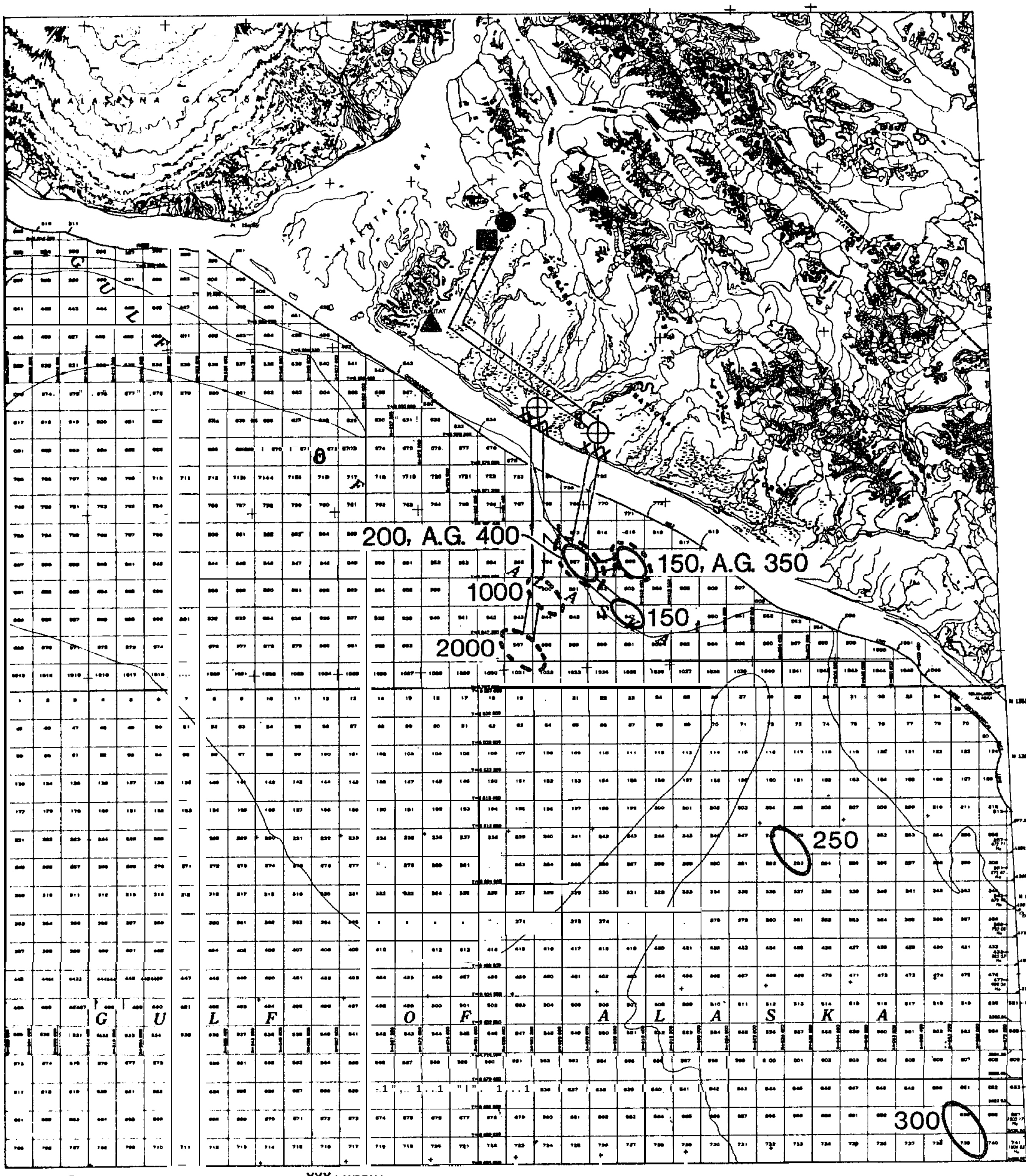
[3] Gasline tied-in with associated gas production: peak throughput, 864 MMCF/D.

[4] Gasline tied-in with associated gas production: peak throughput, 312 MMCF/D.

[5] These fields will not peak at the same time. Time and level of overall peak is not yet determined.

FIGURE 6

YAKUTAT SHELF AREA



KEY: OIL FIELD

GAS FIELD A.G. = ASSOCIATED GAS

OIL & ASSOCIATED GAS FIELD

NOTE: OIL FIELD SIZE GIVEN IN MILLION BARRELS (MMbbl)
GAS FIELD SIZE GIVEN IN BILLION CUBIC FEET (Bcf)

XXX LANDFALL

LNG PLANT

SERVICE BASE

OIL TERMINAL

PUMP STATION / BOOSTER STATION

PIPELINE 0/0S ROAD CORRIDOR

KILOMETERS 0 5 10 20 30 40 50 60

STATUTE MILES 0 5 10 20 30 40

SOURCE: DAMES & MOORE

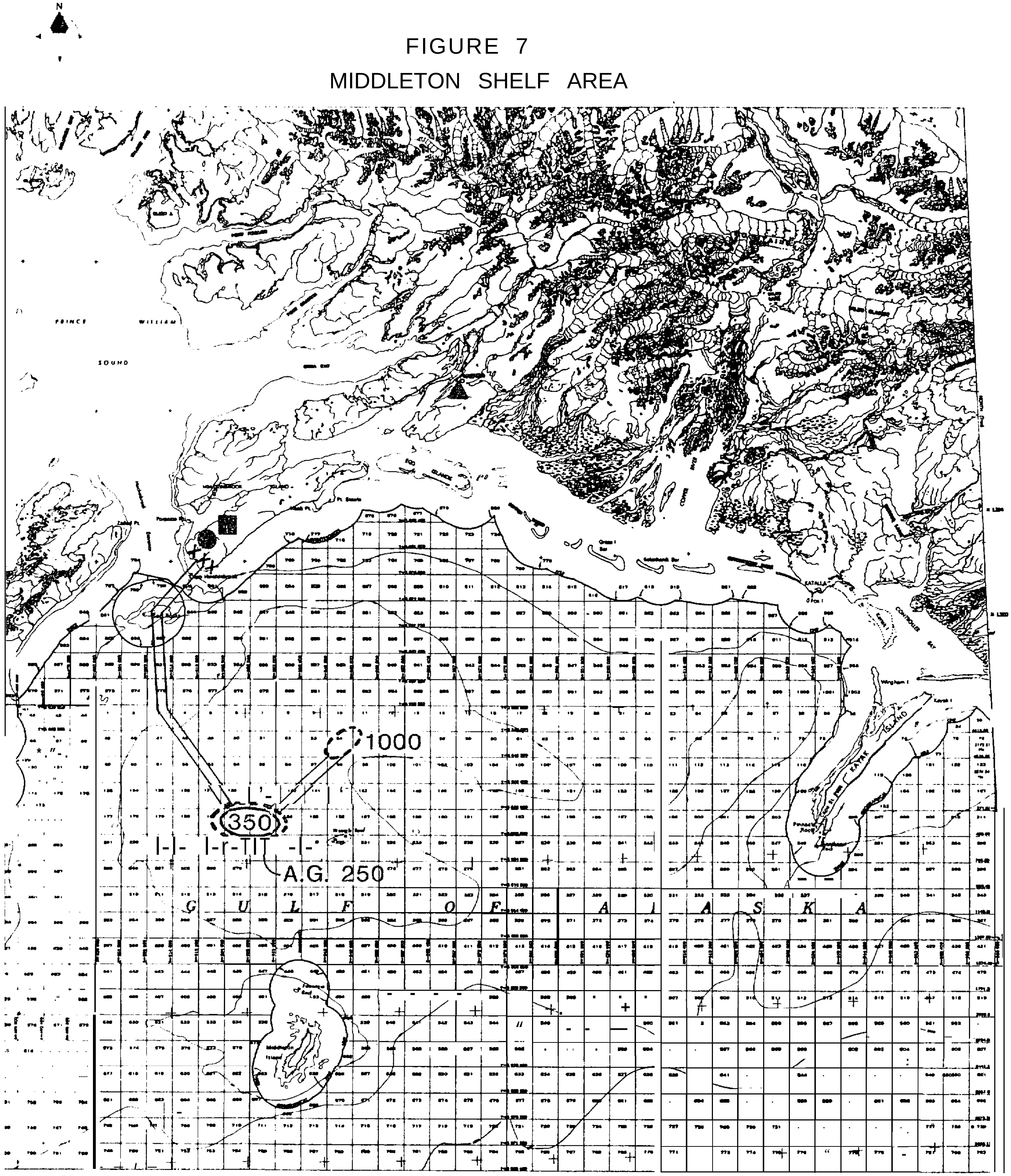
FIELD AND ONSHORE SITE LOCATIONS

STATISTICAL MEAN RESOURCE LEVEL SCENARIO

OIL, ASSOCIATED GAS AND NON-ASSOCIATED GAS

FIGURE 7

MIDDLETON SHELF AREA



KEY:
OIL FIELD
GAS FIELD A.G. = ASSOCIATED GAS
OIL & ASSOCIATED " " " E L "
NOTE, OIL FIELD SIZE GIVEN IN MILLION BARRELS (MMbbl)
GAS FIELD SIZE GIVEN IN BILLION CUBIC FEET (Bcf)

XXX LANDFALL
LNG PLANT
SERVICE BASE
OIL TERMINAL
PUMP STATION/BOOSTER STATION
PIPELINE a/OR ROAD CORRIDOR

KILOMETERS
0 5 10 20 30 40 50 60

STATUTE MILES
0 5 10 20 30 40

SOURCE, DAMES & MOORE

FIELD AND ONSHORE SITE LOCATIONS

STATISTICAL MEAN RESOURCE LEVEL SCENARIO

OIL, ASSOCIATED GAS AND NON-ASSOCIATED GAS

long to continue exploring; which fields, if any-, to develop, and how quickly to develop them, and with what technology. These decisions are, in turn, dictated largely by the characteristics of the fields that are discovered and the natural and social environment in which they are found.

In the two scenarios described in this report that involve petroleum production (the five percent and statistical mean cases), a relatively large amount of employment is generated because of the assumed characteristics of the fields: both gas and oil production are economically feasible, and two sets of major shore facilities are required for production, i.e. an oil terminal and an LNG plant in two widely separated locations -- Yakutat Bay and Port Etches (Hinchinbrook Island).

Tables 6, 7, and 8 present summaries of manpower requirements for the three scenarios. Figures 8, 9, and 10 show graphically the annual monthly average manpower requirements. Maximum manpower demand created by the five percent probability scenario occurs in year 8 when a total of 124,602 man-months of labor are consumed in exploration and development activity. The average monthly manpower requirement in year 8 is 10,384 people. On-site labor consumption in year 8 is 79,246 man-months (this is the amount of direct labor input required by the various tasks, excluding time-off by crews).

In contrast, the statistical mean scenario creates the largest manpower demands in year 10 when a total of 68,153 man-months of labor are consumed. The average monthly manpower requirement in year 10 is 5,680 people. On-site labor force requirements for all industries are 39,353 man-months in this year.

In terms of peak year manpower requirements, the five percent scenario creates about 80 percent more demand for labor than the statistical mean scenario, while some 200 percent more oil reserves and 160 percent more gas reserves are developed in the former scenario than in the latter.

TABLE 6

SUMMARY OF MANPOWER REQU REMENTS FOR ALL INDUSTRIES. 5% RESOURCE LEVEL SCENARIO
ONS TE AND TOTAL

YEAR AFTER LEASE SALE	ONSITE (MAN-MONTHS) OFFSHORE	ONSITE (MAN-MONTHS) ONSHORE	ONSITE (MAN-MONTHS) TOTAL	TOTAL (MAN-MONTHS) OFFSHORE	TOTAL (MAN-MONTHS) ONSHORE	TOTAL (MAN-MONTHS) TOTAL	TOTAL LABOR FORCE (MONTHLY AVERAGE) OFFSHORE	TOTAL LABOR FORCE (MONTHLY AVERAGE) ONSHORE	TOTAL LABOR FORCE (MONTHLY AVERAGE) TOTAL
1	4186.	644.	4830.	7498.	884.	8382.	625.	74.	699.
2	7313.	1126.	8439.	13109.	1546.	14655.	1093.	129.	1222.
3	9406.	1448.	10854.	16858.	1938.	18846.	1405.	166.	1571.
4	11474.	18296.	29770.	20582.	20774.	41356.	1716.	1732.	3447.
5	10440.	44868.	55308.	18720.	50227.	68947.	1560.	4186.	5746.
6	11621.	46702.	58323.	21371.	52126.	73497.	1781.	4344.	6125.
7	20648.	30146.	50794.	39110.	33598.	72708.	3260.	2800.	6059.
8	44663.	34583.	79246.	85534.	39068.	124602.	7128.	3256.	10384.
9	45688.	17784.	63471.	88196.	21252.	109449.	7350.	1771.	9121.
10	50530.	10027.	60556.	97898.	14416.	112314.	8159.	1202.	9360.
11	56044.	10021.	66064.	109134.	14487.	2362 .	9095.	1208.	10302.
12	46503.	8620.	55123.	91134.	13161.	104296.	7595.	1047.	8642.
13	41904.	8016.	49920.	82368.	12672.	95040.	6864.	1056.	7920.
14	38104.	7890.	45994.	74696.	12606.	87302.	6225.	1051.	7276.
15	34560.	7932.	42492.	67608.	12648.	80256.	5634.	1054.	6688.
16	32384.	7980.	40364.	63256.	12696.	75952.	5272.	1058.	6330.
17	30208.	8028.	38236.	58904.	12744.	71648.	4909.	1062.	5971.
18	26208.	7740.	33948.	50904.	12456.	63360.	4242.	1038.	5280.
19	26208.	7740.	33948.	50904.	12456.	63360.	4242.	1038.	5280.
20	25464.	7590.	33054.	49452.	12276.	61728.	4121.	1023.	5144.
21	24960.	7536.	32496.	48480.	12192.	60672.	4040.	1016.	5056.
22	24216.	7386.	31602.	47028.	12012.	59040.	3919.	1001.	4920.
23	23712.	7332.	31044.	46056.	11928.	57984.	3838.	994.	4832.
24	23712.	7332.	31044.	46056.	11928.	57984.	3838.	994.	4832.
25	22968.	7182.	30150.	44604.	11748.	56352.	3717.	979.	4696.
26	20976.	6828.	27804.	40728.	11304.	52032.	3394.	942.	4336.
27	19224.	6570.	25794.	37332.	10956.	48288.	3111.	913.	4024.
28	17976.	5646.	23622.	34908.	9252.	44160.	2909.	771.	3680.
29	17232.	4488.	21720.	33456.	7056.	40512.	2788.	588.	3376.
30	12840.	3666.	16506.	24900.	6044.	30944.	2075.	504.	2579.

TABLE 7

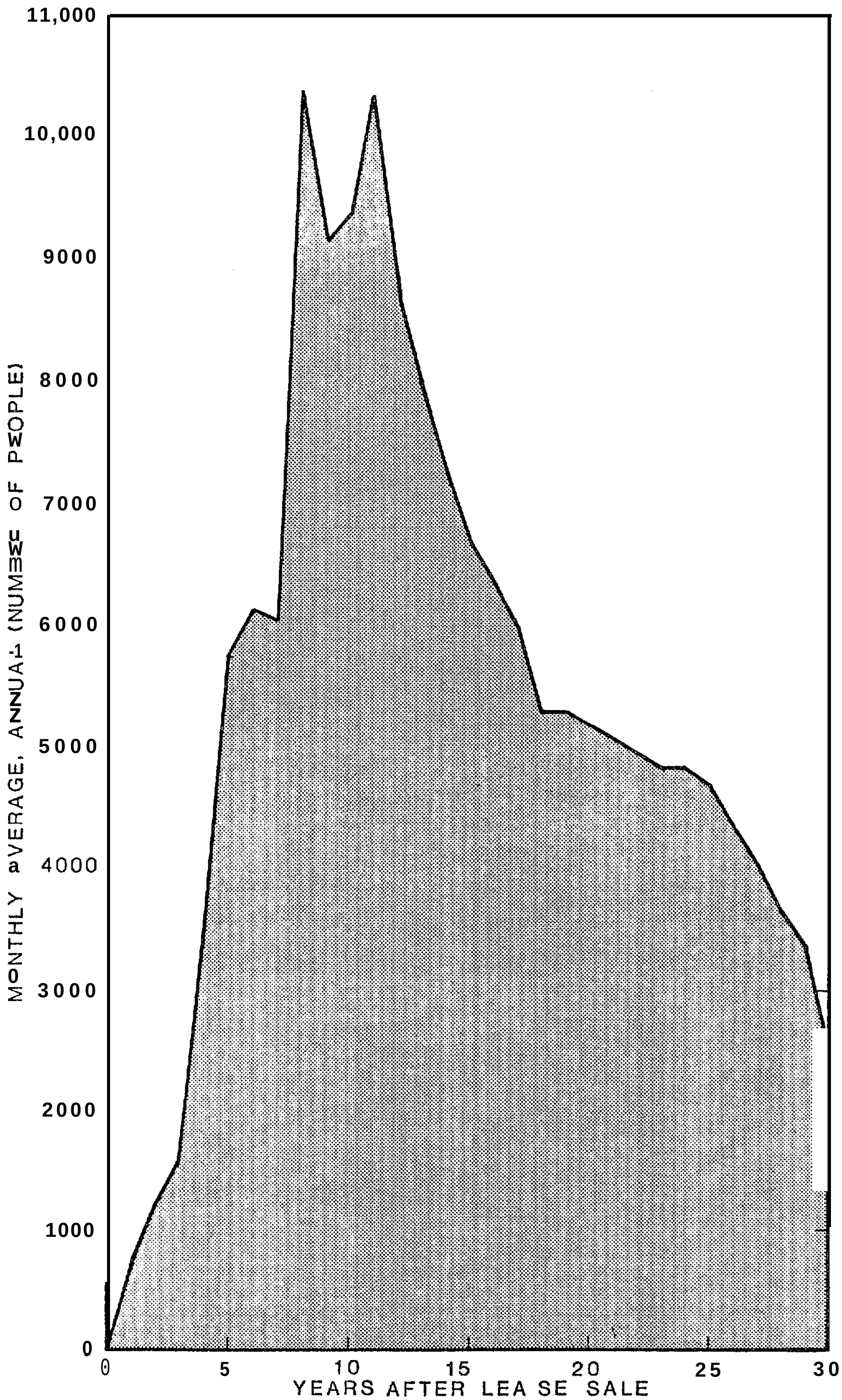
SUMMARY OF MANPOWER REQUIREMENTS FOR ALL INDUSTRIES, STATISTICAL MEAN RESOURCE LEVEL SCENARIO
ONSITE AND TOTAL

YEAR AFTER LEASE SALE	ONSITE (MAN-MONTHS) OFFSHORE	ONSITE (MAN-MONTHS) ONSHORE	ONSITE (MAN-MONTHS) TOTAL	TOTAL (MAN-MONTHS) OFFSHORE	TOTAL (MAN-MONTHS) ONSHORE	TOTAL (MAN-MONTHS) TOTAL	TOTAL LABOR FORCE (MONTHLY AVERAGE) OFFSHORE	TOTAL LABOR FORCE (MONTHLY AVERAGE) ONSHORE	TOTAL LABOR FORCE (MONTHLY AVERAGE) TOTAL
1	3447.	531.	3978.	6180.	729.	6908.	515.	61.	576.
2	4383.	675.	5058.	7860.	927.	8788.	655.	78.	733.
3	7411.	1142.	8553.	13290.	1568.	14858.	1108.	131.	1239.
4	7830.	1206.	9036.	14040.	1656.	15696.	1170.	138.	1308.
5	8347.	6512.	14859.	14971.	7567.	22538.	1248.	631.	1879.
6	10213.	11575.	21788.	18757.	13101.	31858.	1564.	1092.	2655.
7	12179.	18494.	30673.	22813.	20689.	43502.	1902.	1725.	3626.
8	16025.	16161.	32186.	30428.	18793.	49220.	2536.	1566.	4102.
9	25168.	13115.	38283.	48224.	15964.	64188.	4019.	1331.	5349.
10	26931.	12422.	39353.	52084.	16069.	68153.	4341.	1340.	5680.
11	19798.	5417.	25215.	38769.	8789.	47558.	3231.	733.	3964.
12	17136.	4860.	21996.	33660.	8394.	42054.	2805.	700.	3505.
13	16032.	4812.	20844.	31416.	8376.	39792.	2618.	698.	3316.
14	15824.	4860.	20684.	31000.	8424.	39424.	2584.	702.	3286.
15	12272.	4620.	16892.	23896.	8184.	32080.	1992.	682.	2674.
16	11440.	4812.	16252.	22232.	8376.	30608.	1853.	698.	2551.
17	11232.	4860.	16092.	21816.	8424.	30240.	1818.	702.	2520.
18	11232.	4860.	16092.	21816.	8424.	30240.	1818.	702.	2520.
19	11232.	4860.	16092.	21816.	8424.	30240.	1818.	702.	2520.
20	11232.	4860.	16092.	21816.	8424.	30240.	1818.	702.	2520.
21	11232.	4860.	16092.	21816.	8424.	30240.	1818.	702.	2520.
22	9744.	3552.	13296.	18912.	6048.	24960.	1576.	504.	2080.
23	7992.	2874.	10866.	15516.	4860.	20376.	1293.	405.	1698.
24	7488.	2736.	10224.	14544.	4608.	19152.	1212.	384.	1596.
25	7488.	2736.	10224.	14544.	4608.	19152.	1212.	384.	1596.
26	6744.	2586.	9330.	13092.	4428.	17520.	1091.	369.	1460.
27	6240.	2532.	8772.	12120.	4344.	16464.	1010.	362.	1372.
28	5496.	1878.	7374.	10668.	3156.	13824.	889.	263.	1152.
29	2760.	534.	3294.	5340.	852.	6192.	445.	71.	516.
30	504.	54.	558.	972.	84.	1056.	81.	7.	88.

TABLE 8

SUMMARY OF MANPOWER REQUIREMENTS FOR ALL INDUSTRIES, EXPLORATION ONLY SCENARIO
ONSITE AND TOTAL

YEAR AFTER LEASE SALE	ONSITE (MAN-MONTHS)			TOTAL (MAN-MONTHS)			TOTAL LABOR FORCE (MONTHLY AVERAGE)		
	OFFSHORE	ONSHORE	TOTAL	OFFSHORE	ONSHORE	TOTAL	OFFSHORE	ONSHORE	TOTAL
1	4186.	644.	4830.	7498.	884.	8382.	625.	74.	699.
2	4186.	644.	4830.	7498.	884.	8382.	625.	74.	699.
3	3127.	482.	3609.	5611.	662.	6273.	468.	56.	523.
4	870.	134.	1004.	1560.	184.	1744.	130.	16.	146.
5	0.	0.	0.	0.	0.	0.	0.	0.	0.

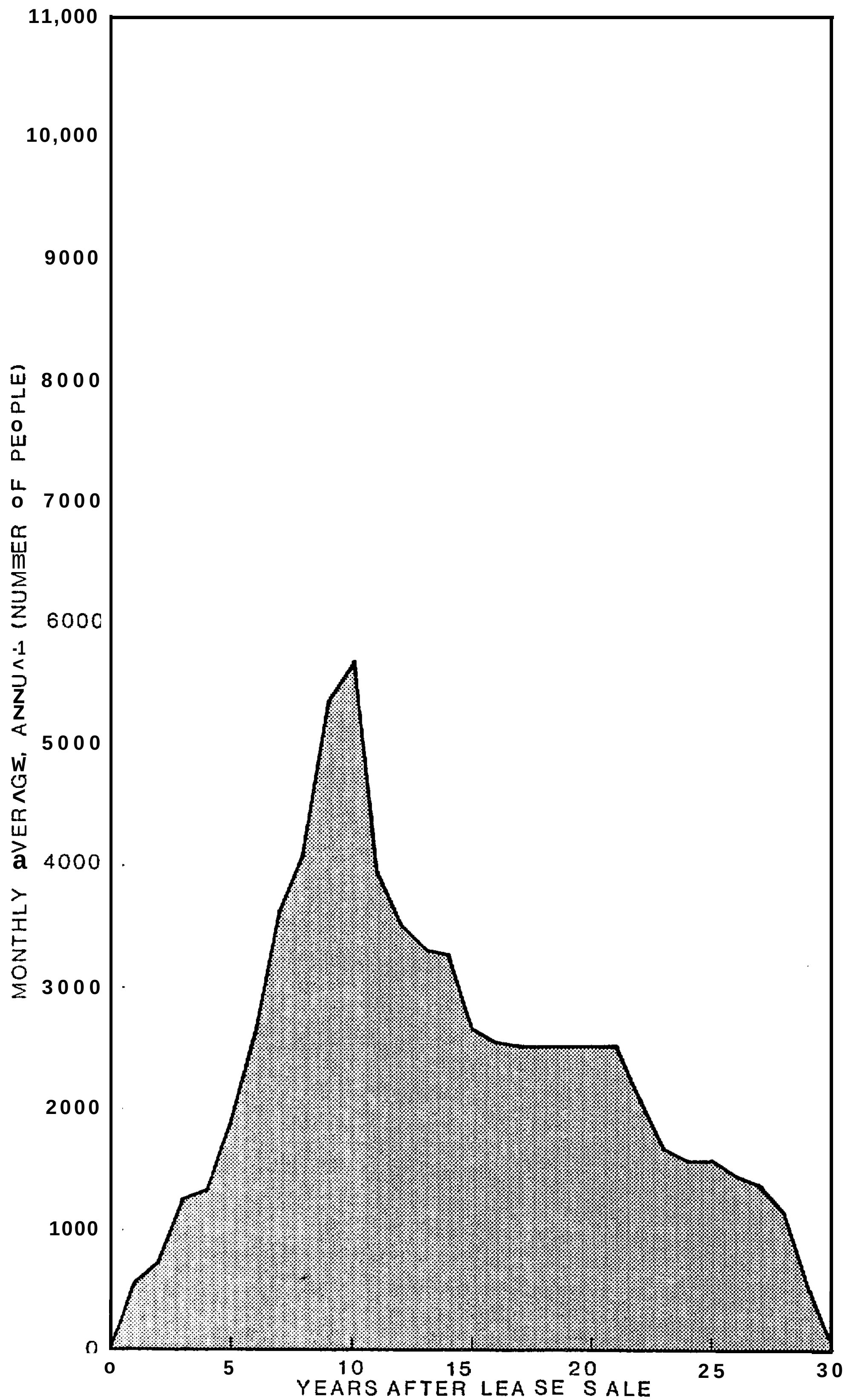


SOURCE: DAMES & MOORE

NOTE: ANNUAL PEAK LABOR FORCE REQUIREMENTS EXCEED THESE AVERAGES: REFER TO TABLES IN SECTION 9.0

FIGURE 8

MANPOWER REQUIREMENTS,
MONTHLY AVERAGE NUMBER OF PEOPLE PER YEAR,
NORTHERN GULF OF ALASKA 5% SCENARIO

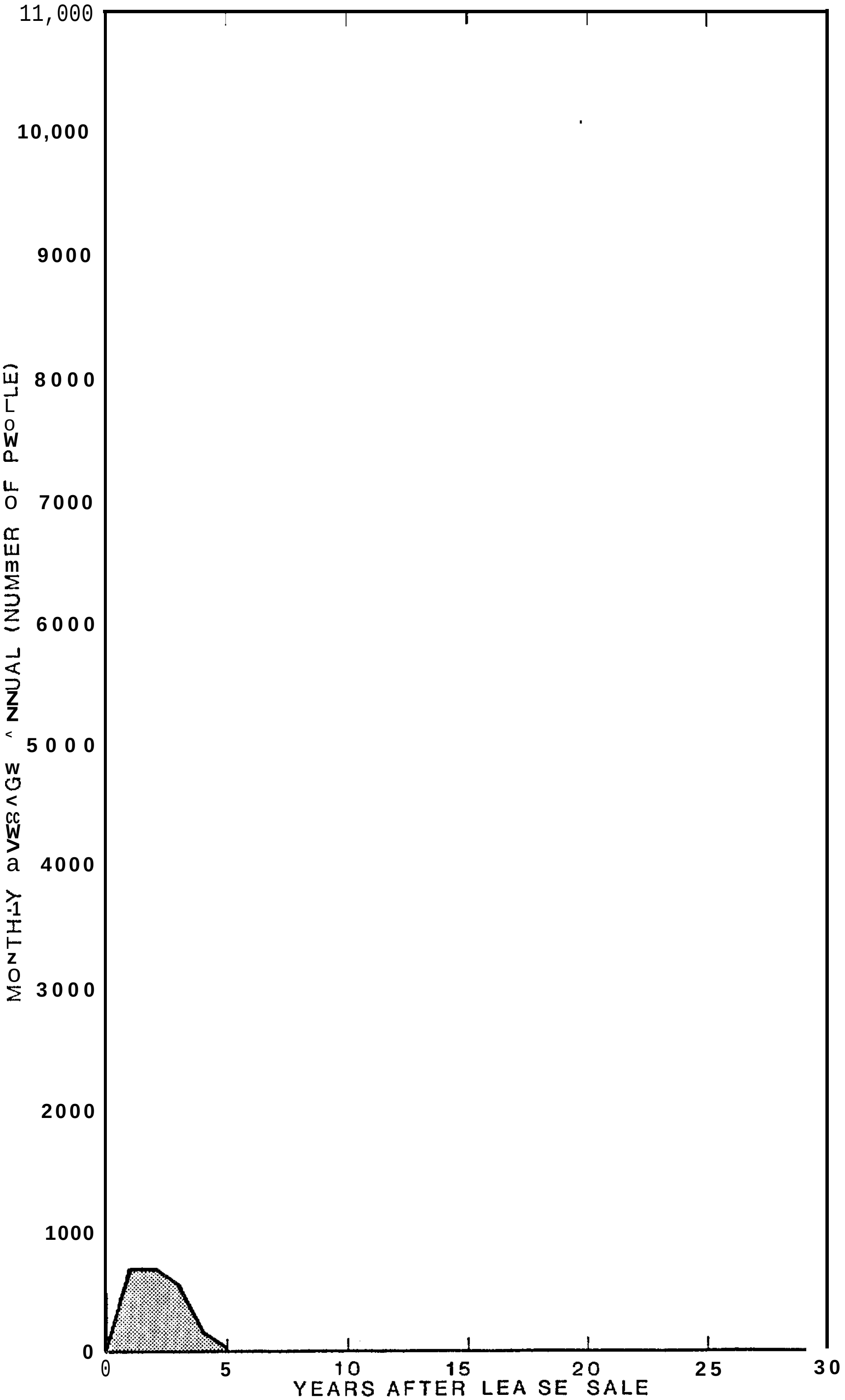


SOURCE: DAMES & MOORE

NOTE: ANNUAL PEAK LABOR FORCE REQUIREMENTS EXCEED THESE AVERAGES; REFER TO TABLES IN SECTION 9.o

FIGURE 9

MANPOWER REQUIREMENTS,
MONTHLY AVERAGE NUMBER OF PEOPLE PER YEAR,
NORTHERN GULF OF ALASKA STATISTICAL MEAN SCENARIO



SOURCE: DAMES & MOORE

NOTE: ANNUAL PEAK LABOR FORCE REQUIREMENTS EXCEED THESE AVERAGES; REFER TO TABLES IN SECTION 9.0

FIGURE 10

MANPOWER REQUIREMENTS,
MONTHLY AVERAGE NUMBER OF PEOPLE PER YEAR,
NORTHERN GULF OF ALASKA 95% SCENARIO

Resource Economics

The economic characteristics of several likely oil and gas production systems suitable for the harsh condition of the Gulf of Alaska are analyzed in this report with the model illustrated in Figure 2. The model is a standard discount cash flow algorithm designed to handle uncertainty among the variables and driven by the investment and revenue streams associated with a selected production technology.

This analysis focuses attention on (1) the engineering technology required to produce reserves in the Gulf of Alaska, and (2) the uncertainty of the interrelated values of the economic and engineering parameters. In view of the uncertainty, it is important to emphasize that there is no single-valued solution for any calculation reported in the analysis. Field development costs associated with the different production systems as well as oil and gas prices have been estimated as a range of values. Sensitivity and Monte Carlo procedures have been used to bracket rather than pin-point the decision criteria calculated with the model.

Two vital pieces of information are estimated in this analysis:

- The minimum economic field size to justify development of a known field with a selected technology in the Gulf of Alaska.

- The minimum required price to justify development of a field in the Gulf of Alaska.

Both are very sensitive to water depth, and to the value of money used to discount cash flows. At water depths of 30.5 meters (100 feet), 91 meters (300 feet), and 183 meters (600 feet), the calculated minimum prices and field sizes are bracketed between 10 percent and 15 percent discount rates.

The essential findings of this report are summarized below. The single value calculations below are the mid-range values although upper and lower limits were also evaluated.

- No oil field smaller than 110 MMbbl at 10 percent value of money is economic in the Gulf of Alaska with any production system tested in 91 meters (300 feet) of water. At 15 percent value of money the minimum field size is 215 MMbbl. Fewer than one percent of oil fields discovered in the U.S. are larger than 100 MMbbl. Of 5,374 fields discovered in the U.S. since 1970, only nine exceeded either 50 MMbbl or 300 Bcf. (1)

- In 183 meters (600 feet) of water no oil production system with the price of oil at $12.00 is economic in the Gulf of Alaska no matter how large the discovered field -- under the assumptions of this analysis, including 2500 B/D initial well production rate -- if the operator requires a 15 percent return on his investment.

- An initial well productivity higher than 2500 B/D is required to earn the 15 percent hurdle rate in 183 meters (600 feet) of water in the Gulf of Alaska. Assuming 7500 B/D initial well productivity the minimum field size for development is 320 million barrels.

- The minimum sized gas field for development ranges between 0.5 and 0.65 Tcf in 91 meters (300 feet) of water at discount rates between 10 percent and 15 percent.

- In 183 meters (600 feet) of water the minimum size gas field for development ranges between 0.7 and 1.75 Tcf at discount rates between 10 percent and 15 percent.

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(1) Oil and Gas Journal, July 13, 1978, p. 33.

- The economics of developing a single field favor a single steel platform with a pipeline to a shore terminal over offshore loading if the cost of the shore terminal is shared among producers of several fields in the Gulf of Alaska.

- Offshore loading systems without storage capacity are much less economic than either systems with storage or systems which will allow a pipeline to a shared shore terminal.

- The economic results are not very sensitive to the distance to shore that a pipeline must travel because its share of development cost is relatively small.

- Under the assumptions of the model, and assuming technical considerations related to reservoir thickness and depth not limiting, the decision to develop a field with two platforms requires a field with recoverable reserves greater than 500 MMbbl. The decision to add a third-platform requires a field larger than 1.0 billion barrels. These field sizes represent those required to optimize the investment rather than the minimum field size for development. Smaller fields allow the minimum hurdle rate with two or three platforms. If technical considerations do not require the additional platform to reach the reservoir, the rate of return is higher with one or two instead of two or three platforms.

- If reservoir thickness or depth dictate development with two platforms of a field smaller than 500 MMbbl, the operator would have to be willing to accept a rate of return lower than 15 percent.

- The minimum required price in 1978 dollars to justify development of the most economic system identified in this report for fields smaller than 500 MMbbl -- the single steel platform with a pipeline to a shared shore terminal -- varies with field size, water depth and value of money.

Field Size	Water Depth: 91 Meters (300 Ft.) 10%	91 Meters (300 Ft.) 15%	183 Meters (600 Ft.) 10%	183 Meters (600 Ft.) 15%
200 MMbbl	$10.00	$14.00	$15.00	>$20.00
350 MMbbl	$7.00	$10.00	$11.00	$16.00

- The minimum required price to justify development of a non-associated gas field varies with field size, water depth and value of money.

Field Size	Water Depth: 91 Meters (300 Ft.) 10%	91 Meters (300 Ft.) 15%	183 Meters (600 Ft.) 10%	183 Meters (600 Ft.) 15%
1.0 Tcf/12 wells	$1.50	$2.10	$2.40	>$2.75
2.0 Tcf/16 wells	$0.75	$1.15	$1.70	$2.45

Technology

Review of current and imminent petroleum technologies indicates that the North Sea to some extent serves as a technology model although there are important environmental contrasts. While oceanographic and meteorologic conditions are similar in the North Sea and Gulf of Alaska (some what more severe storm conditions can be anticipated in the gulf), there are significant contrasts in geology which are particularly important with respect to the feasibility and design of fixed platforms and pipelines. The Gulf of Alaska lies in one of the most seismically active zones in the world and there are extensive areas of potential unstable bottom soils and soils with low bearing capacities. These factors pose design problems for both steel jacket and concrete gravity platforms, the principal types of platforms employed to data in the North Sea. Both platform types can be designed to withstand earthquake loadings but the application of concrete platforms is especially restricted by soil conditions. In the North Sea where seismic risk is minor, seismic loading is not required in platform design.

One of the advantages of the concrete platform has been its storage capability, which significantly improves the economics of offshore loading of crude. An offshore loading system is favored in situations where a pipeline to shore and marine terminal can not be economically justified -- generally where a field is distant from shore and isolated from other fields (with which it could possibly share pipelines and terminals). Offshore storage capability can also be provided by a permanently moored tanker (of uncertain feasibility in the Gulf of Alaska). Storage capability has also been incorporated in a number of proposed "hybrid" platform designs, such as the steel gravity platform, semi-submersible concrete (Condrill) platform and loading/mooring/storage (LMS) platform. Offshore storage may also be provided by steel and concrete storage/loading buoys separate from the drilling/production platform.

To develop marginal fields and fields in deeper water (other factors being equal, for a given field size the deeper the water the greater the field development costs using a fixed platform) a number of floating or compliant platform designs have been proposed. These designs have, in part, been necessitated by the fact that fixed steel or concrete platforms are reaching their limit of economic feasibility (under current economic conditions) at 183 meters (600 feet) water depth in storm-stressed environments such as the North Sea. In less severe operating environments fixed steel platforms have been installed in water depths greater than 183 meters (600 feet), e.g. Exxon's Hondo platform in 260 meters (848 feet) of water in the Santa Barbara channel and Shell's Cognac platform in 313 meters (1,025 feet) of water in the Gulf of Mexico. The floating and compliant platform designs include the guyed tower, articulated tower, tension leg platform and a variety of semi-submersible structures (including converted exploration rigs); the latter two designs are floating structures. Rather than resist environmental loading of waves etc. these platforms are designed to accommodate, to a lesser or greater extent, these forces. Floating and compliant structures require less materials (e.g. steel) to construct, and less offshore construction time. Floating systems involving subsea completed wells can reduce field development time and speed return on investment. For Gulf of Alaska fields, floating systems would also be favored in areas where soil conditions do not favor fixed platforms.

Undoubtedly, the trends in offshore petroleum development in the 1980's, as operations move into deeper waters and marginal fields need to be produced, will include increasing use of hybrid, compliant and floating platform designs and subsea completed wells. To improve the economics of those systems which do not produce into pipelines, offshore storage facilities will be required; probably semi-submersible or buoy structures. Steel jacket platforms and to a lesser extent concrete platforms will still have a major role, at least in waters of less than 183 to 305 meters (600 to 1,000 feet). The trend in design of these structures will (and has been) reduction of weight and material requirements such as steel.

In predicting the production technologies that may be used in Gulf of Alaska petroleum development in the 1980's, the review of petroleum technology has to consider the geography of the Gulf of Alaska, in particular two important considerations:

- The Gulf of Alaska is isolated from petroleum markets and transportation systems (pipelines etc.); most if not all petroleum production will be shipped to the lower 48 states;

- Most potential discovery sites (within the study area) are located less than 50 miles from shore; production through pipelines to shore, other factors being equal, is favored especially if a number of fields are sufficiently close together to share pipeline and shore terminal development costs.

In the selection of production systems for costing and economic screening, it **is important to note that the available** cost data base mainly pertains to conventional fixed platforms with pipeline-to-shore or offshore loading production systems, and there is little or no cost data on the various hybrid and floating/compliant platform systems summarized above. This has, in part, influenced the production systems selected for economic screening. The economic screening has identified those field sizes and locations where more cost effective technologies must be developed to develop such "marginal" fields.

The production systems selected for economic screening are systems currently used in the North Sea which, to various degrees, may have application in the Gulf of Alaska. These are:

- Floating production platform with maximum of 20 producing wells (subsea completions). Limited to 65 percent production due to no storage. Offshore loading with single point mooring. No water depth limitation.

- Single steel jacket platform, limited to 65 percent production due to no storage and inaccessibility of pipeline. Offshore loading with single point mooring. Water depths: 30.5 to 183 meters (100 to 600 feet).(1)

- Single steel jacket platform. Storage buoy allows full production equal to 96 percent of capacity. Water depths: 30.5 to 183 meters (100 to 600 feet).

- Single steel jacket platform. Pipeline to shore terminal shared with other producing fields allows full production equal to 96 percent of capacity. Water depths: 30.5 to 183 meters (100 to 600 feet).

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(1) Water depth ranges specified are those screened in economic analysis of each system.

- Concrete platform. Storage allows full production equal to 96 percent of capacity. Offshore loading with single point mooring. Water depths: 91 to 183 meters (300 to 600 feet).

- Concrete platform as part of a multi-platform field. Pipeline to shore terminal allows full production equal to 96 percent of capacity. Water depths: 91 to 183 meters (300 to 600 feet).

- Multiple steel jacket platforms. Pipeline to shore terminal allows full production equal to 96 percent of capacity. Water depths: 30.5 to 183 meters (100 to 600 feet).

- Single or multiple steel platforms. Gas pipeline to shore, gas converted to LNG. Water depths: 30.5 to 183 meters (100 to 600 feet).

The systems specified above have all been used in the North Sea and are believed to be applicable (with suitable modification), to various degrees, for use in the Gulf of Alaska. While no steel jacket platform system producing direct to tankers in the North Sea to date has had sufficient storage capability to produce full-time at maximum rates (Shell's Brent field SPAR buoy with 300,000 bbl capacity comes closest to this), it has been assumed that offshore storage technology by the 1980's will provide sufficient storage capability in conjunction with production from a steel jacket platform to allow full-time or maximum production.

In the scenarios selected for detailed description, the production systems specified involve fixed platforms with some production to shore via pipeline and some oil production loaded directly to tankers offshore. The offshore loading systems include both platforms with and without storage capacity; for those with storage capacity a steel platform and adjacent storage buoy or concrete platform with internal storage have been indicated. There is insufficient data on bottom geology to properly assess problems relating to the feasibility of concrete platforms or similar gravity hybrids in the Gulf of Alaska except to identify active slump areas which obviously pose problems for fixed platforms, pipelines and subsea equipment. In terms of various industry viewpoints, concrete platforms have evolved from a cost effective alternative to steel platforms to a less favored and more expensive option. Nevertheless, concrete platforms or similar hybrids may have a role in Gulf of Alaska petroleum development and the scenario specifications reflect the same.

Petroleum Geology and Resource Estimates

The basis of the resource estimates used in this study for development of petroleum scenarios are the U.S. Geological Survey estimates of undiscovered oil and gas resources (Plafker et al., 1978). These are:

	95 Percent Probability	50 Percent Probability	5 Percent Probability	Statistical Mean
Oil (billions of barrels)	0	0.5	4.4	1.4
Gas (trillions of cubic feet)	0	2.0	13.0	5.0

These estimates apply to that portion of the Gulf of Alaska Tertiary Province (GATP) located between Cross. Sound in the east and the Anatuli Trough in the west from the shoreline to the 200-meter (650-foot) isobath, an area of approximately 37,135 square kilometers (14,320 square miles). Being a frontier area, the Gulf of Alaska estimates were derived from volumetric-yield methods as described by Miller, et al. (1975, p. 18-19). Furthermore, in the case of frontier areas lacking in detailed geologic information such as the Gulf of Alaska, a marginal or conditional factor is applied which specifies a chance of no commercial occurrence of oil or gas. For the Gulf of Alaska, the U.S. Geological Survey estimates that the probability of no commercial oil or gas is 30 percent. Consequently, the 95 percent probability resource level is zero.

By definition the resources identified above are economically developable with current or imminently available technology (Miller et al., 1975). Allocation of the resources has been based upon the assumption that 75 percent will be located on the Yakutat Shelf and the remaining 25 percent distributed between the Yakataga and Middleton Shelves. This reflects the general opinions of geologists familiar with the Gulf of Alaska.

Available geologic data has permitted identification of about 42 prospects (structures) beneath the Yakutat, Yakataga and Middleton Shelves which may have potential for hydrocarbon accumulations. Geologic data for the Yakutat Shelf (the area of current interest) is particularly poor with only one large structure identified.

There is no producing field analog (except the small and shallow Katalla field which was abandoned in 1932) or sufficient geologic data to establish with any certainty assumptions on reservoir and hydrocarbon characteristics of possible western Gulf of Alaska discoveries. However, a set of reservoir, hydrocarbon and production assumptions have been defined. These include:

- Average reservoir depth -- 2,286 meters (7,500 feet) oil, and 3,810 meters (12,500 feet) gas.
- Recoverable Reserves per Acre -- 20,000 and 50,000 bbl/oil, 120 and 300 mmcf gas.
- Well spacing -- variable.
- Individual well productivity -- oil - 2,500 barrels per day; gas - 25 million cubic feet per day.
- Gas resource -- 80 percent non-associated, 20 percent associated.
- Variable gas-oil ratio (1,000 to 2,500 scf/bbl).
- No assumption was made on oil properties.

REFERENCES

Plafker, G., et al., 1978. Petroleum Potential, Geologic Hazards and Technology for Exploration in the Outer Continental Shelf of the Gulf of Alaska Tertiary Province. U.S. Geological Survey Open-File Report 78-490.